FORM PTO-1390 (REV 10-95) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. §371

ATTORNEY'S DOCKET NUMBER: LINDE 577

U.S. APPLICATION NO. (If known, see 37 CFR §1.5): 10/031568

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/EP00/06900	19 July 2000	20 July 1999

TITLE OF INVENTION

METHOD AND FILLING STATION FOR FILLING A MOTOR VEHICLE WITH GASEOUS FUEL

APPLICANT(S) FOR DO/EO/US

ADLER, Robert.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ■ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. §371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. §371.
3. ☐ This express request to begin national examination procedures (35 U.S.C. §371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. §371(b) and PCT Articles 22 and 39(1).
4. ■ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ■ A copy of the International Application as filed (35 U.S.C. §371(c)(2))
   a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ■ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ■ A translation of the International Application into English (35 U.S.C. §371(c)(2)).
7. ■ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. §371(c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ■ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. §371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. §371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. §371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 C.F.R. §§1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. §§3.28 and 3.31 is included.
13. ■ A FIRST preliminary amendment.
    ☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☐ Other items or information:

U.S. APPLICATION NO. (if known, see 37 CFR §1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
10/031568	PCT/EP00/06900	LINDE 577

17. ☒ The following fees are submitted:

	CALCULATIONS PTO USE ONLY
BASIC NATIONAL FEE (37 CFR §1.492 (a) (1) - (5)):	
Search Report has been prepared by the EPO or JPO..... $890.00	
International preliminary examination fee paid to USPTO (37 CFR §1.482)..... $710.00	
No international preliminary examination fee paid to USPTO (37 CFR §1.482) but international search fee paid to USPTO (37 CFR §1.445(a)(2))..... $740.00	
Neither international preliminary examination fee (37 CFR §1.482) nor international search fee (37 CFR §1.445(a)(2)) paid to USPTO..... $1040.00	
International preliminary examination fee paid to USPTO (37 CFR §1.482) and all claims satisfied provisions of PCT Article 33(2)-(4)..... $100.00	
ENTER APPROPRIATE BASIC FEE AMOUNT =	$890.00
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 C.F.R. §1.492(e)).	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total claims	7 - 20 =	0	x $ 18.00	$0.00
Independent claims	1 - 3 =	0	x $ 84.00	$0.00
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ $ 280.00	
TOTAL OF ABOVE CALCULATIONS =				$890.00
Reduction of 1/2 for filing by small entity, if applicable. A Verified Small Entity Statement must also be				
SUBTOTAL =				$890.00
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 C.F.R. §1.492(f)).				
TOTAL NATIONAL FEE =				$890.00
Fee for recording the enclosed assignment (37 C.F.R. §1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. §§3.28, 3.31). $40.00 per property.				
TOTAL FEES ENCLOSED =				$890.00
			Amount to be refunded:	
			charged:	

a. ■ A check in the amount of $890.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. 13-3402 in the amount of $ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ■ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 13-3402. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 C.F.R. §§1.494 or 1.495 has not been met, a petition to revive (37 C.F.R. §1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO: Customer Number 23,599

23599
PATENT TRADEMARK OFFICE


SIGNATURE

I. William Millen
NAME

19,544
REGISTRATION NUMBER

Filed: 22 JANUARY 2002
IWM:kmo

1/prts

Description

Method and filling station for filling a vehicle tank with a gaseous fuel

The invention relates to a process and a filling station for filling a vehicle with a gaseous fuel, wherein the fuel is compressed, put in temporary storage, and expanded in the vehicle tank, and wherein the fuel has a high hydrogen content.

The invention further relates to a filling station for the process according to the invention with a compressor station and a high-pressure (HP) storage vessel for the gaseous fuel.

In using natural gas a fuel for internal combustion engines, great wear and tear occurs during a cold start since, because of the high hydrogen content in the fuel, a part of the water vapor resulting from the combustion condenses on the cold cylinder wall of the engine. Because of the high piston speeds in the internal combustion engine of about 7 m/s, the water drops condensed on the cylinder wall are accelerated by the pistons, practically without transition time, to the piston speed. This leads to cavitation effects, which destroy the cylinder wall. This makes the condensed water better able to attack and rust the cylinder wall. In engines that are

cold started very often, this leads to about a 30% shortening of its service life. Practically all energy carriers with high hydrogen content lead to these damages.

The object of the invention is to avoid the mentioned drawbacks.

This object is achieved according to the invention by a process with the features of claim 1 and by a filling station with the features of claim 6. Embodiments of the invention are the object of subclaims.

The distinguishing feature of the process according to the invention is that an oil or an oil mixture (additive) is added by doses to the fuel. When an internal combustion engine is cold-started, the oil spray condenses on the cold cylinder wall during the suction stroke (partial vacuum) and covers it with a protective sliding layer, off of which the subsequently condensing water drops slide. This prevents the occurrence of cavitation. Further, the additive destroys the surface tension of the water, largely preventing the formation of drops.

In one configuration of the process according to the invention, the oil or the oil mixture can contain mineral oil and/or synthetic oil.

The fuel can contain the hydrogen as a hydrogen molecule and/or as a hydrocarbon.

The oil or oil mixture can be added so that the highest fuel pressure occurring during filling remains below the

saturated vapor pressure of the oil or a component of the oil. This has the advantage that, during storage of the fuel under pressure following the compression, no condensation of oil or of oil components can occur. Only during expansion in the vehicle tank does the desired oil spray appear.

The distinguishing feature of the filling station according to the invention is that the filling station contains a dosing mechanism for oil or an oil mixture (additive). The dosing mechanism makes it possible to dose continually, controlled by the fuel flow rate. But a simpler configuration with constant dosing, designed for an average fuel flow rate of the compressor fraction, can also be provided. The addition of the additive considerably prolongs the engine service life.

The dosing mechanism can be upstream from the fuel-compressor station or between two compressor stages. The high feed pressure that would be necessary argues against feeding in the additive beyond the compressor station.

The invention will be explained in more detail based on an embodiment with a figure.

Natural gas is withdrawn from a pipeline at a pipeline pressure between, for example, 1 and 10 bars and processed as necessary for use in internal combustion engines: For example, particles are removed and the natural gas is dried to less than 10 mole-ppm. (This processing is not shown in the figure.)

Oil 3 is mixed with the help of a dosing mechanism into natural gas stream 1 prepared this way so that stream 4 contains about 40 to 60 mole-ppm of oil. Stream 4 is fed to a compressor station 5 and compressed in a first compression stage 6 to an intermediate pressure, cooled, compressed as stream 7 in a second compression stage 8 to a final pressure and again cooled. High pressure stream 9 thus obtained is used to fill a high pressure storage vessel 10 up to maximum storage pressure. The filling of vehicles is done from storage vessel 10 by expanding a high pressure stream 11 in the respective vehicle tank until its maximum filling pressure, for example 200 bars, is reached.

Claims

1. Process for filling a vehicle tank with a gaseous fuel, wherein the fuel is compressed, placed in temporary storage, and expanded in the vehicle tank and wherein the fuel has a high hydrogen content, characterized in that an oil or an oil mixture is added in doses to the fuel.

2. Process according to claim 1, wherein the oil or oil mixture contains mineral oil.

3. Process according to claim 1, wherein the oil or oil mixture contains synthetic oil.

4. Process according to one of claims 1 to 3, wherein the fuel contains the hydrogen as a hydrogen molecule and/or as a hydrocarbon.

5. Process according to one of claims 1 to 4, wherein the oil or oil mixture is added so that the highest fuel pressure occurring during the filling remains below the saturation vapor pressure of the oil or a component of the oil.

6. Filling station for performing the process according to one of claims 1 to 5, with a compressor station and a high-pressure (HP) storage vessel for the gaseous fuel, characterized in that the filling station contains a dosing mechanism for oil or an oil mixture.

7. Filling station according to claim 6, wherein the dosing mechanism is upstream from the compressor station or placed between two compressor stages.

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro

(43) Internationales Veröffentlichungsdatum
25. Januar 2001 (25.01.2001)

PCT

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(21) Internationales Aktenzeichen: PCT/EP00/06900

(22) Internationales Anmeldedatum: 19. Juli 2000 (19.07.2000)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:
199 33 791.8 20. Juli 1999 (20.07.1999) DE

(71) Anmelder *(für alle Bestimmungsstaaten mit Ausnahme von US)*: **LINDE GAS AKTIENGESELLSCHAFT** [DE/DE]; Seitnerstr. 70, D-82049 Höllriegelskreuth (DE).

(72) Erfinder; und

(75) Erfinder/Anmelder *(nur für US)*: **ADLER, Robert** [AT/AT]; Lorenz-Steiner-Gasse 34, A-2201 Gerasdorf (AT).

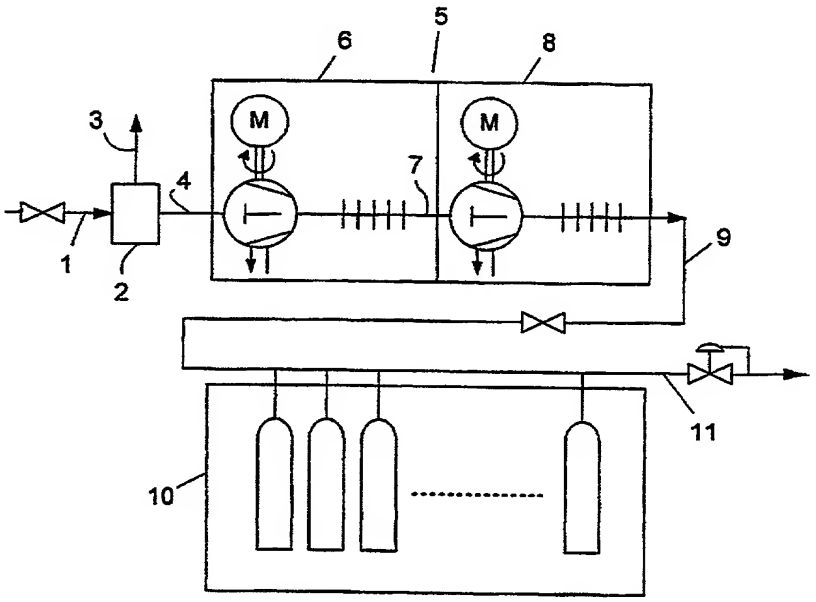
(81) Bestimmungsstaaten *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Bestimmungsstaaten *(regional)*: ARIPO-Patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), eurasisches Patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), europäisches Patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI-Patent

[Fortsetzung auf der nächsten Seite]

(54) Title: METHOD AND FILLING STATION FOR FILLING A MOTOR VEHICLE WITH GASEOUS FUEL

(54) Bezeichnung: VERFAHREN UND TANKSTELLE ZUM BETANKEN EINES FAHRZEUGSTANKS MIT EINEM GASFÖRMIGEN TREIBSTOFF



(57) Abstract: The invention relates to a method and a filling station for filling a motor vehicle with gaseous fuel. The fuel is compressed, stored temporarily and expanded in the fuel tank of said vehicle. The fuel has a high water content. According to the invention, oil or an oil mixture is added in a dosed manner to said fuel.

[Fortsetzung auf der nächsten Seite]

WO 01/06172 A1

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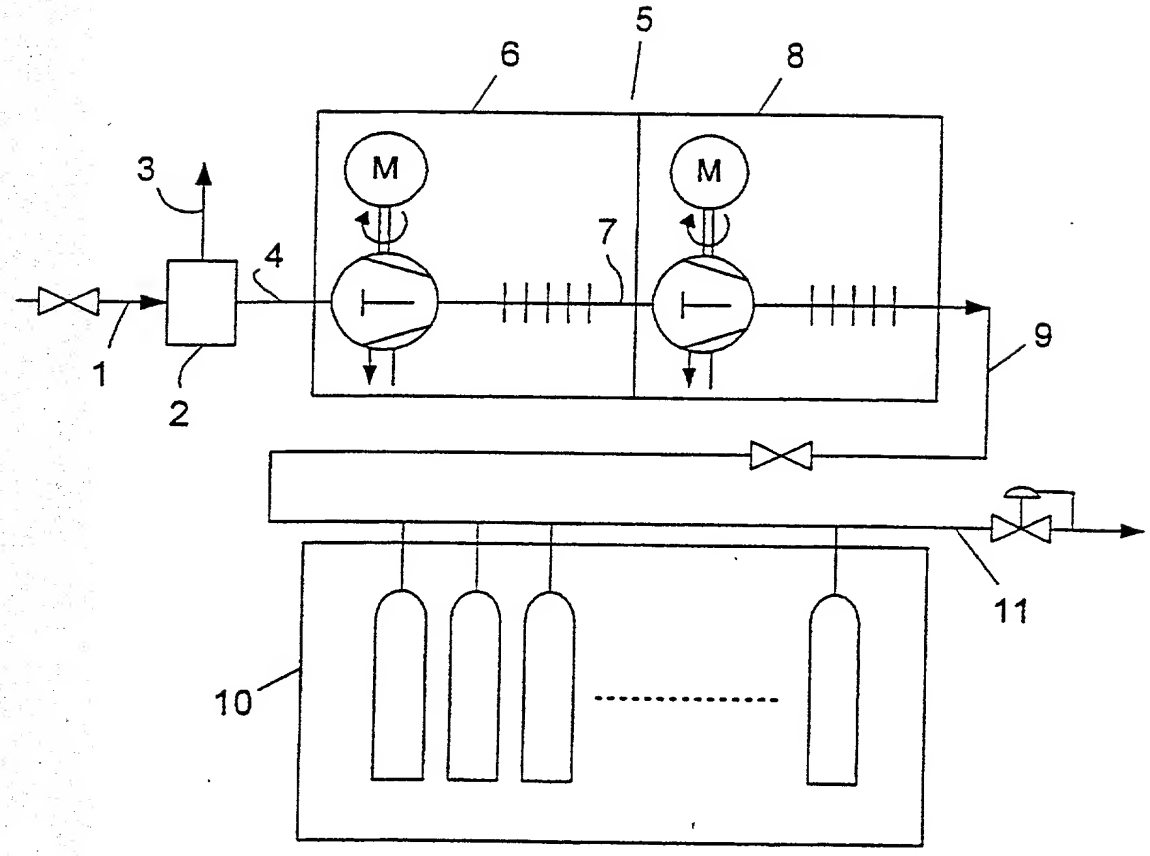

Fig.

IN THE UNITED STATES DESIGNATED/ELECTED OFFICE

International Application No.	:	PCT/EP00/06900
International Filing Date	:	19 JULY 2000
Priority Date(s) Claimed	:	20 JULY 1999
Applicant(s) (DO/EO/US)	:	ADLER, Robert

Title: METHOD AND FILLING STATION FOR FILLING A MOTOR VEHICLE WITH GASEOUS FUEL

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

SIR:

Prior to calculating the national fee, and prior to examination in the National Phase of the above-identified International application, please amend as follows:

IN THE CLAIMS:

4. (Amended) Process according to claim 1, wherein the fuel contains the hydrogen as a hydrogen molecule and/or as a hydrocarbon.

5. (Amended) Process according to claim 1, wherein the oil or oil mixture is added sot that the highest fuel pressure occurring during the filling remains below the saturation vapor pressure of the oil or a component of the oil.

6. (Amended) A filling station for performing the process according to claim 1, comprising a compressor station and a high-pressure (HP) storage vessel comprising gaseous fuel, and wherein the filling station contains dosing means for oil or an oil mixture.

7. (Amended) A filling station according to claim 6, wherein the dosing means is disposed upstream from the compressor station or placed between two compressor stages.

REMARKS

The purpose of this Preliminary Amendment is to eliminate multiple dependent claims in order to avoid the additional fee. Applicants reserve the right to reintroduce claims to canceled combined subject matter.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached pages are captioned "**Version With Markings to Show Changes Made**".

Respectfully submitted,

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LINDE ~~326~~577

VERSION WITH MARKINGS TO SHOW CHANGES MADE

Claims 4 to 7 were amended as follows:

4. (Amended) Process according to ~~one of~~ claims 1 ~~to 3~~, wherein the fuel contains the hydrogen as a hydrogen molecule and/or as a hydrocarbon.

5. (Amended) Process according to ~~one of~~ claims 1 ~~to 4~~, wherein the oil or oil mixture is added sot that the highest fuel pressure occurring during the filling remains below the saturation vapor pressure of the oil or a component of the oil.

6. ~~F~~(Amended) A filling station for performing the process according to ~~one of~~ claims 1 ~~to 5~~, ~~with~~comprising a compressor station and a high-pressure (HP) storage vessel ~~for the~~comprising gaseous fuel, ~~characterized in that~~and wherein the filling station contains ~~a~~ dosing ~~mechanism~~means for oil or an oil mixture.

7. ~~F~~(Amended) A filling station according to claim 6, wherein the dosing ~~mechanism~~means is disposed upstream from the compressor station or placed between two compressor stages.

20 MAY 2002

Attorney Docket Number: LINDE 577

DECLARATION FOR PATENT APPLICATION

10/031560

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

METHOD AND FILLING STATION FOR FILLING A MOTOR VEHICLE WITH GASEOUS FUEL

the specification of which

☐ is attached hereto

■ was filed on 19 JULY 2000 as United States Application Number or PCT International Application Number PCT/EP00/06900 and (if applicable) was amended on _____

I hereby authorize our attorneys to insert the serial number assigned to this application.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 USC §119			
APPLICATION NO.	COUNTRY	DAY/MONTH/YEAR FILED	PRIORITY CLAIMED
199 33 791.8	GERMANY	20 JULY 1999	YES

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below.

PROVISIONAL APPLICATION(S) UNDER 35 U.S.C. §119(e)	
APPLICATION NUMBER	FILING DATE

I hereby claim the benefit under 35 U.S.C. §120 of any United States application, or §365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. §112.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR §1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

PRIOR U.S./PCT INTERNATIONAL APPLICATION(S) DESIGNATED FOR BENEFIT UNDER 37 U.S.C. §120		
APPLICATION NO.	FILING DATE	STATUS — PATENTED, PENDING, ABANDONED

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith: I. William Millen (19,544); John L. White (17,746); Anthony J. Zelano (27,969); Alan E.J. Branigan (20,565); John R. Moses (24,983); Harry B. Shubin (32,004); Brion P. Heaney (32,542); Richard J. Traverso (30,595); John A. Sopp (33,103); Richard M. Lebovitz (37,067); John H. Thomas (33,460); Catherine M. Joyce (40,668); Nancy J. Axelrod (44,014); James T. Moore (35,619); James E. Ruland (37,432); Jennifer J. Branigan (40,921) and Robert E. McCarthy (46,044)

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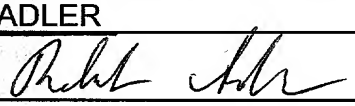
Send Correspondence to Customer Number 23599

23599

PATENT TRADEMARK OFFICE

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full Name of sole or first inventor (given name, family name) 1(a) Robert ADLER	
Signature 	Date 26. 2. 2002
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Full Name of additional joint inventor (given name, family name)	
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Residence	Citizenship
Post Office Address	
Full Name of additional joint inventor (given name, family name)	
Signature	Date
Residence	Citizenship
Post Office Address	
Full Name of additional joint inventor (given name, family name)	
Signature	Date
Residence	Citizenship
Post Office Address	

☐ Additional joint inventors are named on separately numbered sheets attached hereto.